

CHAPTER 4

PROJECT SUPERVISOR

The mission of the Naval Mobile Construction Battalion (NMCB) includes operational readiness, construction, defense, and disaster preparedness operations. To achieve these assigned missions, the NMCB is organizationally structured for the dual purpose of construction and military support operations.

The commanding officer (CO) of the NMCB has direct responsibility for the timely preparedness and successful completion of all construction projects and disaster recovery operations assigned to the NMCB by higher authority. The operations officer (S-3) is responsible to the CO for management of the construction and disaster preparedness programs. Additionally, the operations officer is granted direct supervisory authority over the utilization of the battalion's construction resources: personnel, equipment, and materials. The element in the overall NMCB organization by which the battalion's mission is accomplished is the company structure (fig. 4-1).

The NMCB is composed of two categories of companies: construction companies and line

companies. Construction companies are designated as Alfa, Bravo, Charlie, and Delta. These companies have the capabilities needed for direct mission accomplishment. Headquarters company is the line company and serves as the military and administration organization for the NMCB.

Within the battalion, Alfa company has the primary responsibility for the operation and maintenance of all assigned automotive, construction, and weight-handling equipment. Under the construction concept of *prime contractor/lead company*, Alfa company performs as a prime or subcontractor, sometimes both, for assigned construction projects. The prime contractor is responsible for the safety, quality, and timeliness of the construction effort and directs subcontract support accordingly. The subcontractor is responsible for providing resources in sufficient quantity and quality to accomplish a portion of a construction project according to schedules.

The Alfa company commander (A-6) is directly responsible to the operations officer (S-3) for Alfa company assigned projects. The Alfa company operation chief (A-3) is responsible to the company commander for all prime and subproject support and normally assigns a projects chief (A-32) to support the management of the construction projects. The company commander, company operation chief, and projects chief, and usually, the company chief jointly review the preliminary construction tasking for an assigned prime project or projects. They then select the project supervisor(s) who is/are given the responsibility to carry out the project tasking. The company selected project supervisor is appointed by the operations officer for the assigned construction project.

PROJECT SUPERVISOR RESPONSIBILITIES

In some commands, the project supervisor is referred to as the "crew leader." In this chapter, the term *project supervisor* refers to the individual assigned as the person in charge of a construction project. This chapter presents the basic information you are required to know in order to perform the duties and carry out your responsibilities when assigned as a project supervisor.

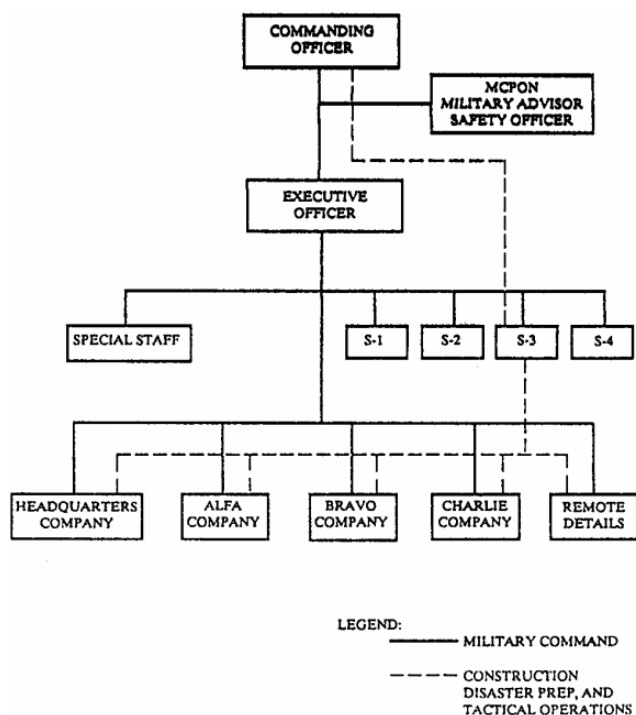


Figure 4-1.—Model of an NMCB organization.

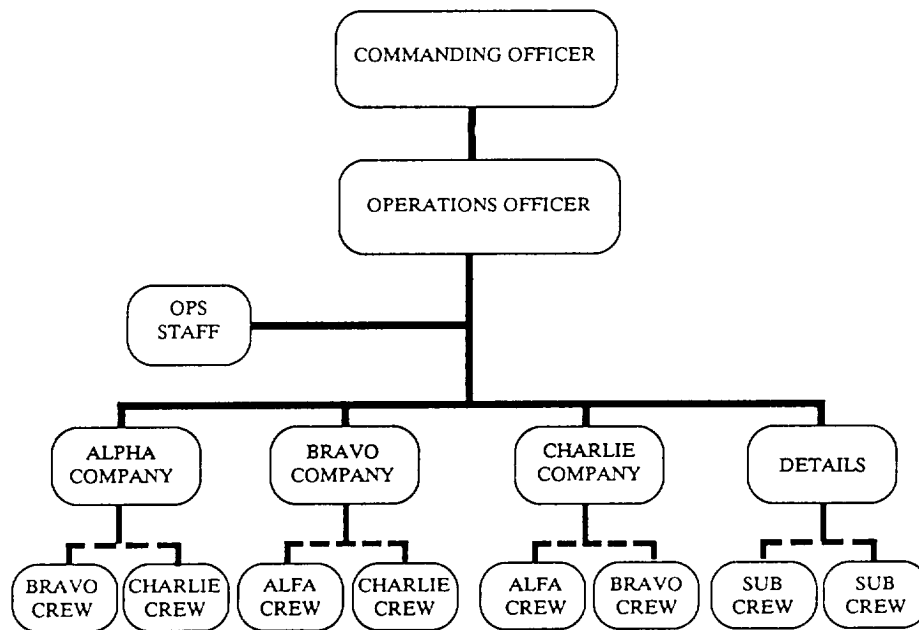


Figure 4-2.-Prime contractor/lead company organization.

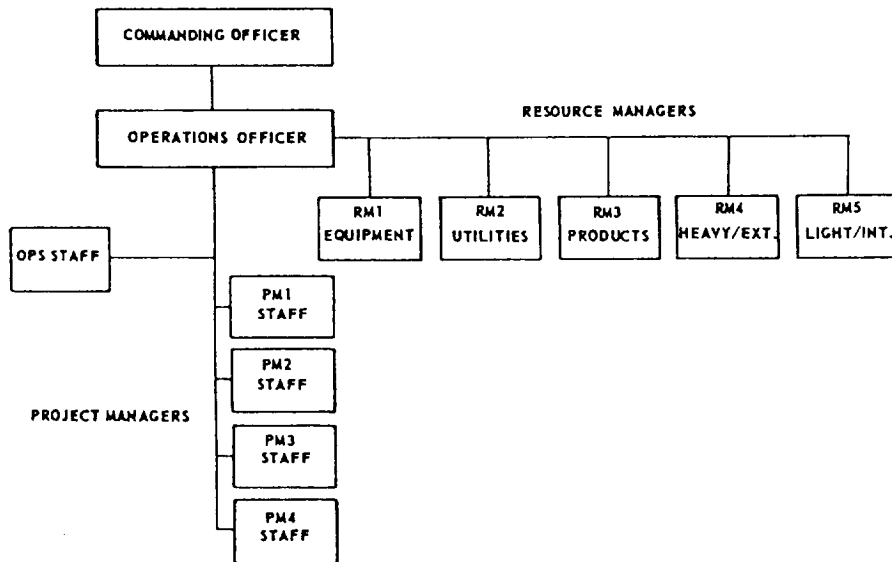


Figure 4-3.-Project manager/resource manager organization.

CONCEPTS OF CONSTRUCTION

Construction operations are conducted under several different organizational concepts. Depending upon the particular objectives of each deployment, the CO and the S-3 officer determine the organizational concept that is most effective for the execution of the assigned objectives while maintaining readiness integrity. Although there are many variations that can be used in a construction organization, there are three

concepts that are most often used by the Naval Construction Force (NCF). These concepts are as follows:

- Prime contractor/lead company
- Project manager/resource manager
- Self-sufficient unit/detail

Most construction operations in the NCF are conducted under the *prime contractor/lead company*

concept (fig. 4-2). In this organization the company commanders are directly responsible to the operations officer for the timely and successful completion of construction projects assigned to them by the operations officer. The *project manager/resource manager concept* (fig. 4-3) requires construction projects be assigned directly to a project manager who is normally outside the company organization. The project managers are then responsible directly to the operations officer for the completion of the project to include the following: planning, scheduling of resources, direct project supervision, and reporting. The entire battalion labor force is reorganized into resource "pods," either by rate or by type of work to be accomplished (such as block crews, concrete crews, finish crews, and wiring crews). A resource manager is placed in charge of each pool. The resource manager has the responsibility to utilize their assigned personnel, tools, and equipment effectively, without regard to project assignment, and provide the administration support required by the military organization. The *self-sufficient unit concept* (fig. 4-4) is used when the battalion establishes details to accomplish specific tasks at locations remote from the main body site. These details are organized and staffed with all resources required to accomplish the specific assigned mission; therefore, the self-sufficient unit. The three concepts are outlined in the *Naval Construction Force Manual*, NAVFAC P-315.

No matter what construction concept is used, the prime contractor, project manager, or the officer in charge (OIC) of the self-sufficient unit is directly responsible to the operations officer.

DEPLOYMENT PLANNING

The key to a successful deployment is well-developed plans. This planning phase begins 2 months before the end of the previous deployment and continues through the end of home port. More details of how construction projects are planned and laid out are covered in the *Naval Construction Force/Seabee Petty Officer First Class*, NAVEDTRA 10601, and the *Naval Construction Force/Seabee Chief Petty Officer*, NAVEDTRA 10600. The following is a general overview of how deployment tasking is planned. The planning phase is subdivided into seven distinct steps: *initial planning step*, *follow-on planning step*, *detailed planning step*, *predeployment trip step*, *ready-to-deploy evaluation step*, *advance party phase (final evaluation step)*, and the *main body arrival step*.

The *initial planning step* is the period in which the battalion receives its preliminary tasking and begins

DETAIL ORGANIZATION

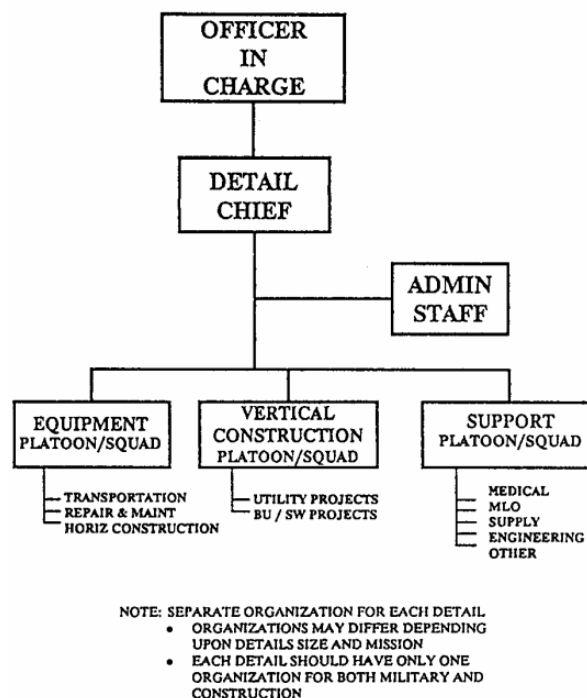


Figure 4-4.-Self-sufficient unit organization.

monitoring the efforts, plans, tasking, and work load of the on-site battalion at the next deployment site. The battalion also organizes a planning group that consist of personnel who are knowledgeable individuals in their particular rating. This group monitors the planning and estimating of the construction projects and performs as the quality control (QC) team during the deployment.

The *follow-on planning step* is the preliminary evaluation involving the in-depth study of all information received to date and the monitoring of the on-site battalions efforts. Part of the in-depth study is to evaluate any additional training needs for battalion personnel and to review and develop an overall method of execution for any particular project. After the preliminary evaluation is completed, the appropriate number of personnel for each detail, company, and staff elements are assigned. his evaluation should yield a significant number of questions which are normally resolved by message traffic, direct contact, or during the predeployment trip.

When the *detailed planning step* is reached, the battalion is ready to commence the project planning function. At this time, the companies and details become the primary planning units within the battalion. Also, this is when the project supervisor becomes involved with the planning and it is during this phase that the

project package is developed. Project packages are covered in the *NCF Seabee Petty Officer First Class*, NAVEDTRA 10601.

The quality control (QC) element assists the companies and details with the planning effort and coordinates the detailed analysis of project requirements. The analysis includes a distribution of resources required during various time frames to accomplish the battalion mission and also the monitoring of the on-site battalion's efforts and projecting the point at which each project should be turned over. This information, coupled with modifications to existing networks and new networks, is coordinated into a schedule. This schedule is based on the best information available and is subject to change as new information is received or as priorities change.

In conjunction with the detailed analysis and scheduling effort, each company reviews the bill of materials (BM) provided for a project and determines if it is complete. Each company also checks what tools and materials on the BM are required for each of the network activities. An estimate of all tools, equipment, personnel, time, material resources, quality control, safety plans, and special training requirements is developed during this step. This schedule is reviewed by the battalion staff and compared with the actual resources available to determine and resolve any excesses and deficiencies. After this step is completed, a preliminary overall battalion deployment plan should exist that indicates all projected evolutions of the battalion during the upcoming deployment and the schedule to accomplish them.

The *predeployment trip step* is a critical aspect in evaluating the project planning efforts of the battalion. This trip normally includes a visit to the main body and all current and anticipated detail sites.

The *ready-to-deploy evaluation step* is a readiness-to-deploy inspection (RDI) conducted by the regimental operations staff in three phases during the home-port period. The first phase inspection covers the battalion organizational and training plans; the second phase inspection covers the construction project plans; and the third phase covers the execution plans. These inspections are necessary to ensure that the battalion is well prepared for the upcoming deployment.

The *advance party phase* is the final evaluation step. During this phase, the advance party deploys to the main body site and to the various detail sites. Also, the monitoring efforts and planning accomplished by the

battalion up to this time are finalized to ensure proper employment of personnel.

The *main body arrival step* indicates the end of the primary planning cycle and commencement of the execution phase of the work; however, planning efforts of the battalion do not stop at this point, but assume a different role in the battalion's operations.

EARTHWORK COMPUTATIONS

Companies that are assigned as a prime contractor for a construction project are responsible for the full planning and estimating (P&E) of the project; however, areas of construction not relating to their specific skills normally require assistance from companies assigned as subcontractor for the planning and estimating of their area of expertise.

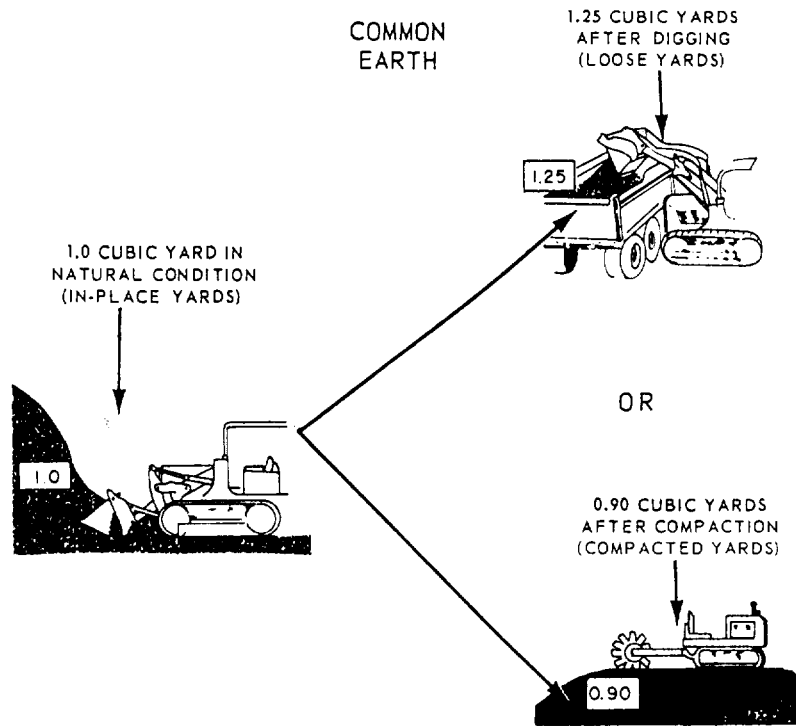
Normally, Alfa company is assigned to what is known as *horizontal construction*. The scope of the project is usually the primary factor in determining if Alfa company is assigned as the prime or subcontractor. As the project supervisor, you must be thoroughly knowledgeable of and stay on top of all P&E evolutions concerning your project. P&E estimates are used as a basis for purchasing materials and for determining equipment and manpower requirements. These estimates are also used in scheduling progress, which provides the basis for scheduling material deliveries, equipment, and manpower. You should review the project specifications and construction drawings and check all quantity estimates for accuracy. Mistakes made in P&E can be detrimental to the successful completion of the construction project.

Earthwork computations are calculations of earthwork volumes or quantities used to determine the following: final grades, balance cut and fill requirements, and PLANNING the most economical movement of material. Earthwork computations are a critical element in the planning of any project and the importance of these calculations cannot be overemphasized.

Volume Changes

Most earth moving is computed in cubic yards; however, on some deployment sites, the metric system is used. A cubic yard is a cube 3 feet long, 3 feet wide, and 3 feet high. Many dimensions in field measurements and contract plans are in feet; therefore, when they are multiplied together to obtain bulk (length x width x depth), the results

Table 4-1.-Volume Changes



SOIL TYPE	PRESENT SOIL CONDITION	CONVERTED TO:		
		INPLACE	LOOSE	COMPACTED
SAND	INPLACE	1.00	1.11	0.95
	LOOSE	0.90	1.00	0.86
	COMPACTED	1.05	1.17	1.00
COMMON EARTH	INPLACE	1.00	1.25	0.90
	LOOSE	0.80	1.00	0.72
	COMPACTED	1.11	1.39	1.00
CLAY	INPLACE	1.00	1.43	0.90
	LOOSE	0.70	1.00	0.63
	COMPACTED	1.11	1.59	1.00
ROCK	INPLACE	1.00	1.30 - 2.00	1.25 - 1.50
	LOOSE	0.50 - 0.77	1.00	0.75 - 0.96
	COMPACTED	0.67 - 0.80	1.04 - 1.33	1.00

obtained are in cubic feet. To convert cubic feet into cubic yards, divide the cubic feet by 27 (there are 27 cubic feet in 1 cubic yard). Another method is to divide each original linear measurement by 3 to convert the number of feet into yards; then multiply the values together to cubic yards. Be aware, however, that this method may lead to working in fractions, decimals, and mixed numbers.

Cubic yards of material are either *inplace*, *loose*, or *compacted*. Material excavated in its natural state

increases in volume, commonly known as *swell*. Undisturbed material is measured as *inplace cubic yards*, material loosened by handling is measured in *loose cubic yards*, and the volume of compacted material is measured as *compacted cubic yards*. You must remember when calculating estimates from prints, cuts are estimated as *inplace cubic yards*, and fills are estimated as *compacted cubic yards*. To calculate the correct amount of material to be handled, you can convert the present soil conditions using table 4-1.

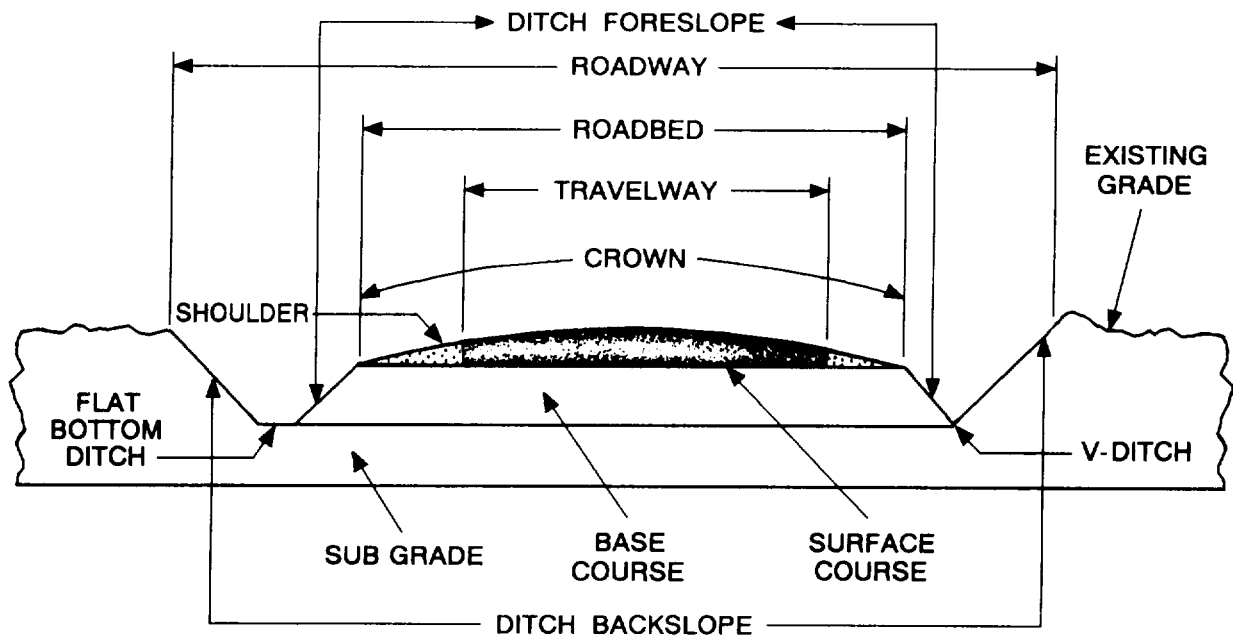
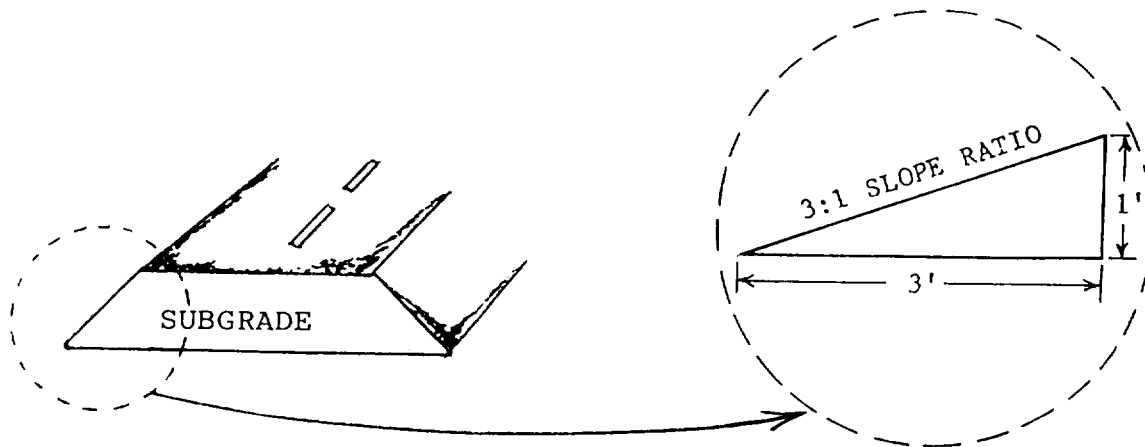
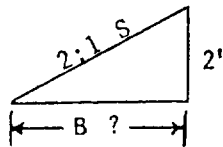


Figure 4-5. Road terminology.

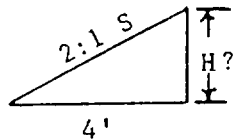


3:1 (3 to 1) slope = 3' of horizontal distance for every one(1) foot of rise.



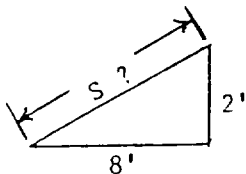
$$\text{SLOPE (2:1) X HEIGHT (2')} = 4' \text{ BASE}$$

$$S \times H = B$$



$$\text{BASE (4')} \div \text{SLOPE (2:1)} = 2' \text{ HEIGHT}$$

$$B \div S = H$$



$$\text{BASE (8')} \div \text{HEIGHT (2')} = 4 (4 \text{ to } 1) \text{ 4:1 SLOPE}$$

$$B \div H = S$$

Figure 4-6. Slope ratio.

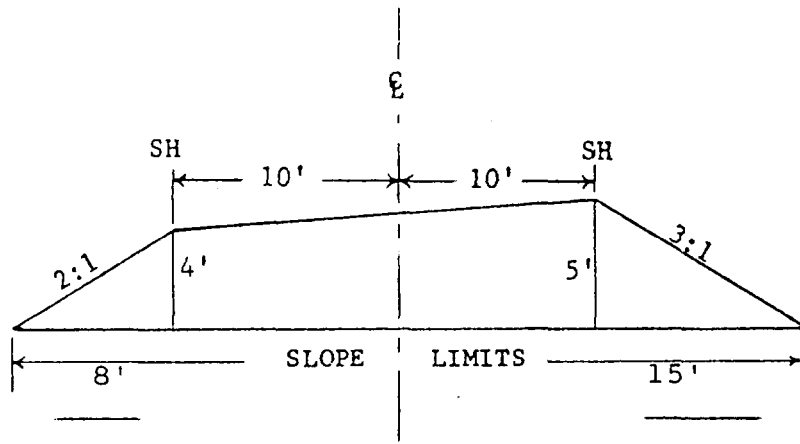


Figure 4-7.—Cross section.

Road Nomenclature

Part of the planning and estimating process is making sure your crew has the understanding of road terminology (fig. 4-5). Before any construction is performed on a project site, the elevation is known as *existing grade*. The driving surface of an existing road that is to be replaced is also known as the *existing grade*. The *subgrade* of a road is a prepared base for the placement of base course materials. The *base course* is a select layer of well-compacted soil that is placed in compacted lifts on top of the subgrade. This compaction can be accomplished by mechanical stabilization or chemical stabilization. The *surface course* and the *shoulders* complete the road. The surface course is usually concrete or asphalt and is part of the road that vehicles travel on. The shoulder of the road performs as a retainer on each side of the surface course and allows for an emergency parking area.

The *crown* of the road is an established slope from the center line of a roadbed to the outside of the shoulders and allows for excess water to drain from the surface into either a *V-type* or *flat bottom* ditch. The area that covers the entire width of the road project including the ditches is known as the *roadway*. The *roadbed* is the section that includes the surface course and both shoulders, and the *travelway* is the surface course that the vehicle travels on.

Slope Ratio

The two most common slopes used in road construction are the *backslope* and *foreslope*. The backslope extends from the top of the cut at the existing grade to the bottom of the ditch. The foreslope extends from the outside of the shoulder to the bottom of the

ditch. The amount of slope in a backslope or foreslope is the ratio of horizontal distance to vertical distance (fig. 4-6). This means that for every 1 foot of vertical (up or down) distance, the horizontal distance changes proportionally. The following are equations used to compute slope ratio:

1. If the base and the height are known factors, but not the slope, use:

$$\text{Base} \div \text{Height} = \text{Slope}$$

$$(B \div H = S)$$

2. If the slope ratio and height are known factors, but not the base, use:

$$\text{Slope} \times \text{Height} = \text{Base}$$

$$(S \times H = B)$$

3. If the base and the slope ratio are known factors, but not the height, use:

$$\text{Base} \div \text{Slope} = \text{Height}$$

$$(B \div S = H)$$

Cross Sections

A *cross-sectional view* (fig. 4-7) that is given for a road project is a cutaway end view of a proposed station between the left slope and the right slope. Typical cross sections are plotted at any intermediate place where there is a distance change in slope along the center line where the natural ground profile and grade line correspond. The cross section displays the slope limits, slope ratio, horizontal distance between centerline stakes and shoulder stakes. It also shows the vertical distance of the proposed cut or fill at the shoulder and centerline stakes.

TO COMPUTE THE AREA OF A CROSS SECTION, FIRST BREAK IT DOWN INTO GEOMETRIC FIGURES (SQUARES, TRIANGLES, ETC.); THEN COMPUTE EACH AREA SEPARATELY AND TOTAL THE RESULTS.

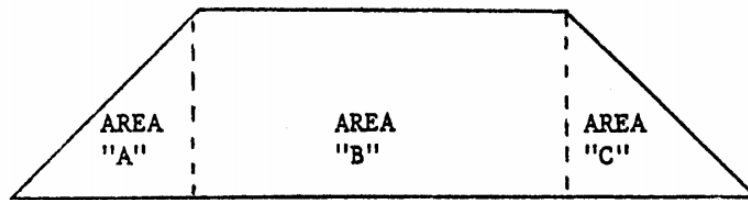


Figure 4-8.-Geometric sections of a cross section.

SQUARES and RECTANGLES may be computed for area by using the formula:

$$\text{AREA} = \text{BASE} \times \text{HEIGHT} \quad (A = B \times H)$$

EXAMPLE:

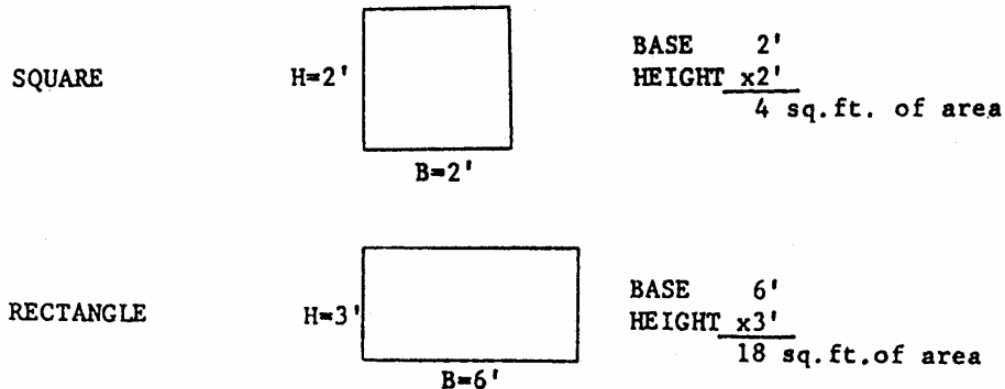


Figure 4-9.-Area of a square and rectangle.

To compute the area of a cross section, you must first break it down into geometric figures (squares, triangles, etc.). (See fig. 4-8.) Compute each area separately, then total the results to obtain the total square feet. To compute the square feet area of a SQUARE or RECTANGLE (fig. 4-9), use the following equation:

Area = Base \times Height or $(A = B \times H)$.
(See fig. 4-9.)

Since a RIGHT TRIANGLE is a square or rectangle cut in half diagonally, the same equation can be used to compute the area and the result divided by 2 (fig. 4-10). For example;

$$\text{Triangle area in square feet} = \frac{\text{Base} \times \text{Height}}{2}$$

$$\text{or } B \times H \div 2 = \text{Triangle square feet}$$

Another geometric figure you may encounter in a cross section is a TRAPEZOID (fig. 4-11). The equation to compute the area of a trapezoid is as follows:

$$\text{Trapezoid Area in square feet} = \left(\frac{H_1 + H_2}{2} \right) \times L$$

or H_1 = Height of one side

+ H_2 = Height of other side

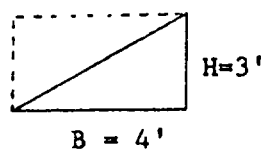
Sum $\div 2 \times$ Length = Trapezoid area in square feet.

The next step is to compute the total area in the cross section (fig. 4-12). This is accomplished by adding the results of each geometric figure in the cross section. This value is the total end area of the cross-sectional view.

To compute the amount of cubic yards between two cross sections, use the following equation:

THE FORMULA FOR COMPUTING THE AREA OF A TRIANGLE IS AS FOLLOWS:

$$\text{AREA} = \frac{\text{BASE} \times \text{HEIGHT}}{2} \quad \text{or } B \times H \div 2$$

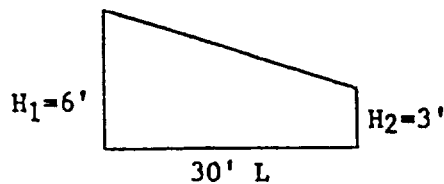


$$\begin{array}{r} \text{BASE} \quad 4' \\ \text{HEIGHT} \times 3' \\ \hline 2) 12 = 6 \text{ sq. ft.} \end{array}$$

Figure 4-10.-Area of a triangle.

THE FORMULA FOR COMPUTING THE AREA OF A TRAPEZOID IS AS FOLLOWS:

$$\text{AREA} = \frac{H_1 + H_2 \times L}{2}$$

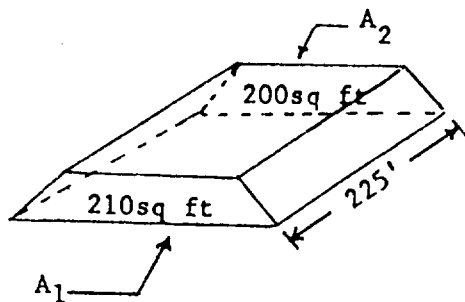


$$\begin{array}{r} H^1 = 6' \\ H^2 = +3' \\ \hline 2) 9 = 4.5 \times 30' = 135.0 \text{ sq. ft.} \end{array}$$

Figure 4-11.-Area of trapezoid.

THE FORMULA FOR COMPUTING CUBIC YARDS IS AS FOLLOWS:

$$(A_1 + A_2) 1.85 \times \text{DISTANCE} = \text{CUBIC YARDS}$$



$$\begin{array}{r} A_1 = 210 \quad \text{sq ft} \\ A_2 = +200 \quad \text{sq ft} \\ \hline 410 \\ \times 1.85 \quad \text{FACTOR} \\ \hline 2050 \\ 3280 \\ 410 \\ \hline 758.50 \\ \times 2.25 \quad \text{DISTANCE} \\ \hline 379250 \\ 151700 \\ 151700 \\ \hline 1706.6250 \\ 1706.63 \quad \text{CUBIC YARDS} \end{array}$$

Figure 4-12.-Computing cubic yards of cross sections.

CONSTRUCTION ACTIVITY SUMMARY SHEET

PROJECT TITLE: _____

B.M. CODE: _____ PREPARED BY: _____ CHECKED BY: _____

START SCHEDULED: _____ FINISH SCHEDULED: _____

ACTUAL: _____ ACTUAL: _____

ACT. NO. _____ ACT. CODE _____

ACT. TITLE: _____

DESCRIPTION OF WORK METHOD: _____

DURATION: ESTIMATED _____ MANDAYS: ESTIMATED _____ WORKWEEK: _____
 ACTUAL _____ ACTUAL _____

PRODUCTION EFFICIENCY FACTOR: _____ RESULTING DELAY FACTOR: _____

LABOR RESOURCES:

NO.	DESCRIPTION	QTY.	NO.	DESCRIPTION	QTY.

EQUIPMENT RESOURCES:

NO.	DESCRIPTION	QTY.	NO.	DESCRIPTION	QTY.

MATERIAL RESOURCES:

L/I	DESCRIPTION	U/I	QTY.	NO.	DESCRIPTION	U/I	QTY.

ASSUMPTIONS: _____

Figure 4-13.-CAS sheet.

$$(A_1 + A_2) \times 1.85 \times \text{Distance} = \text{Cubic yards}$$

A_1 = Area of one end cross section

A_2 = Area of other end of cross section

1.85 = Constant factor

D = Distance between two end areas that must be changed to a decimal form; for example, 250 feet = 2.50, 125 feet = 1.25, 75 feet = .75, and so forth

To compute the equation take the area of one end section (cross section) plus the area of the other end and multiply the sum of the two areas by a constant factor of 1.85. This value should now be multiplied by the distance between the two end areas to determine the number of cubic yards. (See fig. 4-12.)

Earthwork equations to compute the volume of concrete are outlined in chapter 7. Other areas, such as equations to compute for prime and tack costs, single- and double-surface treatments, and asphalt volumes, are outlined in chapter 8.

EQUIPMENT ESTIMATES

Equipment estimates are used with production schedules to determine the construction equipment requirements and constraints for a construction project. One fact that must be remembered is that the speed of the equipment usually averages between 40 to 56 percent of the posted speed limit. The primary factors responsible for the variation in the percentage of the posted speed limit are as follows: road conditions, the

number of intersections, the amount of traffic, and hauling distances. Other factors considered are the types of material hauled (for example, damp sand or loam is much easier to handle than clay), safety (equipment limitations), operator experience, conditions of the equipment, work hours, and the local climate.

Equipment production must be determined so the amount and type of equipment may be selected. Equipment production rates are available in the *Seabee Planner's and Estimator's Handbook*, NAVFAC P-405. The handbook provides information on estimating construction work elements and material quantities, including equipment and manpower requirements. The production rate per day should be estimated for each piece of equipment. Consider the factors discussed above, information obtained from NAVFAC P-405, and your experience. The quantity of work divided by the production rate per day produces the number of days required to perform the project. Equipment required to support each construction activity is documented on the Construction Activity Summary Sheet (CAS sheet) (fig. 4-13), which is part of the project package. One of the purposes of the project package is to allow the project supervisor and the assigned P&E crew to perform a documented thorough analysis of their assigned project and to lay out an organized sequence plan of operation in order to complete the assigned tasking. Detailed information on project packages, project planning, project execution, and construction project supervision are outlined in the *Naval Mobile Construction Battalion Crew Leader's Handbook*.

